REMARKS

Claims 7, 8, and 10 were rejected under Section 102 based on Mizutani. There, it was asserted, despite the absence of any translation, that Mizutani teaches, in Figure 1 and the related text, a method comprising forming a metallic precursor 3, 4 directly on a semiconductor substrate 1 and oxidizing said metallic precursor in liquid oxidizer.

As the attached translation, obtained online from the Japanese Patent Office, indicates, the item 1 is not a semiconductor substrate, but an insulating substrate made of glass. See paragraph 32. In fact, a semiconductor material 5 is used, but it is deposited on top of the already oxidized films 3 and 4. See paragraph 32.

Therefore, there is no forming a metallic precursor directly on a "semiconductor" substrate and oxidizing said metal precursor in a liquid. To the contrary, the metallic material is deposited directly on a non-semiconductor substrate, oxidized, and then semiconductor material is applied thereafter.

Therefore, reconsideration of the rejection is respectfully requested.

It should be noticed that the Japanese Patent Office warns that the document is translated by computer and so the translation may not reflect the original precisely. However, it is believed that it is a burden on the Patent Office to obtain its own translation.

Respectfully submitted,

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PRIOR ART

[Description of the Prior Art] Various industrial use is presented with the metal and the alloy using the characteristic property. Since specific resistance is especially small, aluminum, an aluminium alloy, etc. are effectively used to wiring of a TFT component or an integrated circuit. In order to make it not short-circuit these wiring between other wiring or an electrode, to form an insulator layer in a front face is needed.

[0003] As an approach of forming an insulator layer in front faces, such as aluminum and an aluminium alloy, there is a chemical conversion method by anodic oxidation. this approach -- front faces, such as aluminum and an aluminium alloy, -- formation -- it is the approach of forming an oxide film in that front face by oxidizing electrochemically in liquid. Since this approach has the function which restores the defect resulting from the heterogeneity of a substrate, it is excellent in the point which can form a precise and smooth oxide film easily. For this reason, the oxide film forming method by chemical conversion is effectively used in the wiring production process of a TFT component or an integrated circuit.

[0004] the formation used for oxide film formation of aluminum, an aluminium alloy, etc. -- various constituents are proposed as liquid until now. for example, the formation which mixed an ammonium pentaborate water solution or 3% tartaric-acid water solution, and propylene glycol 1% in JP,61-133662,A 1:3 -- liquid is used. moreover, the formation which diluted the tartaric-acid water solution with ethylene glycol or propylene glycol 3%, and adjusted pH to about seven with aqueous ammonia in JP,2-85826,A -- liquid is used. the formation which mixed 1% ammonium tartrate water solution, 1% adipic-acid ammonium water solution, 1% ammonium oxalate water solution or 1% ammonium citrate water solution, and ethylene glycol by the volume ratio 3:7 in JP,6-216389,A -- liquid is used.

[0005] the formation which mixed a tartaric-acid water solution, 15% acetic acid, and ethylene glycol 3% in JP,8-50304,A 9:1:10 -- liquid is used. the water solution of the organic-acid ammonium salt chosen from the water solution, ammonium tartrate and ammonium citrate, the adipic-acid ammonium, the phthalic-acid ammonium, the ammonium oxalate, ammonium salicylate, and ammonium carbonate of the inorganic-acid ammonium salt chosen from tetraboric-acid ammonium, 5 ammonium pentaborate, and ammonium pentaborate in JP,8-286209,A -- formation -- it is used as liquid.

[0006] moreover, the formation which dissolved the salt of an inorganic acid in the solvent which has an alcoholic hydroxyl group in JP,11-229157,A -- liquid -- JP,11-246994,A the formation which dissolved the salt of aromatic carboxylic acid in the

solvent which has an alcoholic hydroxyl group -- the formation which dissolved the salt of the aliphatic series dicarboxylic acid of the carbon numbers 3-5 which do not have a hydroxyl group in the solvent which has an alcoholic hydroxyl group for liquid in WO 99/No. 25906 official report -- the formation which dissolved the solute chosen from the salt of liquid and inorganic oxo acid, and the salt of an organic carboxylic acid in the solvent which is mainly concerned with an aprotic organic solvent -- liquid is used.

EFFECT OF THE INVENTION

[Effect of the Invention] clear from Table 1 -- as -- formation of this invention -- the case where liquid is used -- the conventional formation, compared with the case where liquid is used, the insulation of the anodic oxidation object coat formed is high. moreover, formation of this invention -- the oxide film formed using liquid can prevent growth of a hillock also in subsequent high temperature processing. namely, formation of this invention -- if liquid is used, the oxide film with which insulation is high with an oxide film and can control a hillock effectively can be manufactured. formation of this invention -- liquid can be widely used for the product and components for which anodic oxidation of a metal especially aluminum, or an aluminium alloy is needed If it uses for insulator layer formation of gate wiring of a TFT component especially, needlessness or when it can be made thin, the dependability of a component can also raise a SiN insulator layer. Moreover, also when it uses for wiring of an integrated circuit, since withstand voltage can be made high, dependability can be raised.

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] however, the above-mentioned formation -- about liquid, even if it anodizes a metal, especially aluminum and an aluminium alloy using this, the oxide film which has sufficient insulation cannot be formed. For this reason, in order to prevent dielectric breakdown, another insulator layer must be further formed on the formed oxide film. Especially on the occasion of manufacture of a TFT component, with the CVD method, the thick SiN film is formed on an oxide film, and insulation is compensated. Since a CVD method is performed at an elevated temperature, the needlelike minute projection called the hillock produced in the aluminum content surface of metal at this time grew, and it broke through gate dielectric film, and has also derived the problem of making a display panel producing a defect.

[0008] the formation which can form the oxide film which uses this invention for anodic oxidation of a metal especially aluminum, or an aluminium alloy, and is excellent in insulation, and a hillock cannot generate easily -- it aims at offering the metal which has the high insulation oxide film by which hillock generating was controlled by the approach insulation forms a good metal oxide film by liquid and the high throughput using it, and its approach.

MEANS

[Means for Solving the Problem] the formation which comes to contain the salt of amino acid as a result of this invention persons' advancing examination wholeheartedly in view of this situation as a solute -- it came to complete a header and this invention for the ability of the oxide film which has a very good property to be formed by anodizing a metal using liquid.

[0010] namely, the object for metal oxide film formation to which the summary of this invention comes to contain the salt of amino acid as a 1. solute -- formation -- formation given in liquid 2.1 term -- it is in the metal which comes to form an oxide film in a front face by the approach given in formation approach 3.2 term of a metal oxide film including the process which anodizes a metal in liquid.

[0011]

[Embodiment of the Invention] Hereafter, this invention is explained to a detail.

(For metal oxide film formation formation liquid) formation of this invention -- it is characterized by liquid coming to contain the salt of amino acid as a solute. formation of this invention -- as long as it is the compound which has an amino group and a carboxyl group in a monad about the amino acid used for liquid, it may not be limited especially and a natural thing or a natural composite thing is [any of an L type, D mold, and DL mold are sufficient as the mold, and] sufficient as it.

[0012] As an example of amino acid, for example A glycine, an alanine, a valine, a leucine, Neutral amino acid, such as an isoleucine (monoamino monocarboxylic acid); An amino malonic acid, An aspartic acid, glutamic acid, alpha-aminoadipic acid, alpha-amino pimelic acid, Acidic amino acid of ** (monoamino dicarboxylic acid); Basic amino acid (diamino monocarboxylic acid); phenylalanines, such as a lysine and an arginine, Aromatic amino acid, such as a thyrosin; Sulfur-containing-amino-acid; serines, such as a cysteine, a cystine, and a methionine, Oxyamino acid, such as threonine; A histidine, a tryptophan, a proline, Amino acid which has heterocycles, such as a hydroxyproline; an asparagine, a glutamine, hydroxyproline, a glycylglycine, a glutathione, gamma-aminobutyric acid, aminocaproic acid, a diamino Valerin acid, a citrulline acid, etc. can be illustrated. These can also be used independently and can also be used combining plurality.

[0013] In this invention, it is desirable to use acidic amino acid also in this amino acid, and it is especially desirable independence or to use an aspartic acid or glutamic acid, mixing. Especially the cation for forming the salt of these amino acid is not restricted. For example, ammonium ion, alkali-metal ion, 1 and 2, and gin can use the fourth class alkyl ammonium ion, phosphonium ion, the sulfonium ion, etc. Especially, it is desirable to use ammonium ion, 1, 2 and 3, or the fourth class alkyl ammonium ion. The magnitude of the alkyl group in the case of using alkyl ammonium ion can be chosen in consideration of the solubility to a solvent. Usually, the alkyl group of carbon numbers 1-4 is chosen.

[0014] These solutes may use a kind independently and may use it combining two or more sorts. Moreover, you may use it combining the above-mentioned solute and solutes other than the above. formation of this invention -- as for the solute concentration of liquid, it is common to set it as 0.001 - 30% of the weight of within the limits, and it is desirable to set it as 0.05 - 15% of the weight of within the limits. Even if forming [of a metal oxide film] becomes that solute concentration is less than 0.001 % of the weight inadequate since conductivity is insufficient, and solute concentration uses it exceeding

30 % of the weight, it is an opposite effect at the engine performance of about [not being economical] and a metal oxide film.
[0015] formation of this invention -- the main solvent used for liquid is a non-aqueous solvent. Here, the main solvent means that the rate in a solvent is 50 % of the weight or more. As a non-aqueous solvent, the solvent and aprotic organic solvent which have an alcoholic hydroxyl group are desirable, and the solvent which has an alcoholic hydroxyl group is more desirable in these.
[0016] although not limited especially about the solvent which has an alcoholic hydroxyl group, fatty alcohol is desirable and can mention polyhydric alcohol, such as dihydric alcohol; glycerols, such as monohydric-alcohol; ethylene glycol, such as a methanol, ethanol, 1-propanol, 2-propanol, 1-butanol, a 2-ethyl-1-hexanol, and a cyclohexanol, propylene glycol, butane -1, 4-diol, and a diethylene glycol, and pentaerythritol, as the example, for example. Moreover, the solvent which has functional groups other than an alcoholic hydroxyl group in intramolecular can also be used unless the expected effectiveness of this invention is checked. For example, the solvent which has an alkoxy group can also be used like 2-methoxyethanol or diethylene glycol monoethyl ether.
[0017] About an aprotic organic solvent, any of a polar solvent or a nonpolar solvent may be used. as a polar solvent, gamma-butyrolactone, gamma-valerolactone, delta-valerolactone, etc. are annular -- carboxylate; methyl acetate -- Chain-like carboxylate, such as methyl propionate; Ethylene carbonate, Annular carbonates, such as propylene carbonate, butylene carbonate, and vinylene carbonate; Dimethyl carbonate, Chain-like carbonates;N-methyl formamides, such as ethyl methyl carbonate and diethyl carbonate, N-ethyl formamide, N.N-dimethylformamide, N, and N-diethyl formamide, Amides, such as N-methyl acetamide, N,N-dimethylacetamide, and N-methyl pyrrolidone; An acetonitrile, Nitril, such as guru taro nitril, an adiponitrile, a methoxy acetonitrile, and 3-methoxy propionitrile; phosphoric ester, such as trimethyl phosphate and triethyl phosphate, can be illustrated.
[0018] Moreover, a hexane, toluene, a silicone oil, etc. can be illustrated as a nonpolar solvent. These solvents may use a kind independently and may use it combining two or more sorts. formation of this invention -- especially a desirable solvent is independent or the mixed solvent of ethylene glycol and propylene glycol for liquid. Moreover, as a solvent, less than 30% of the weight of water can also be added and used preferably less than 50% of the weight. The content of water in case a solvent contains water is less than 0.1 - 20 % of the weight more preferably less than 0.1 to 25% of the weight.
[0019] (The formation approach of a metal oxide film) formation of this invention -- liquid can be used effective in metaled anodic oxidation. the formation currently used from the former -- although the oxide film which has a good property to a metal was not able to be formed with liquid -- formation of this invention -- the oxide film which was excellent when using liquid can be formed.
[0020] namely, formation of this invention -- if a metal is anodized using liquid -- the conventional formation -- compared with the case where it anodizes using liquid, insulation can form a high oxide film. moreover, formation of this invention -- if it anodizes using liquid -- the conventional water-solution system -- formation -- liquid -- comparing -- constant current -- since the time amount which formation takes is short and ends, it can manufacture by the high throughput.
[0021] furthermore, formation of this invention -- if the oxide film is formed using liquid,

generating and growth of a hillock by high temperature processing in a subsequent process can also be controlled. therefore, formation of this invention -- if liquid is used, an oxide film with high withstand voltage can be formed efficiently. moreover, formation of this invention -- the oxide film formed using liquid may function also as the impurity cutoff sex skin film, the protective film of wiring or a substrate, a protective coating, a coloring coat, and a hygroscopic coat.

[0022] an operation of the amino acid with which the effectiveness which was excellent in such this invention has an amino group and a carboxyl group in intramolecular although it does not adhere to any theory -- formation -- the time -- formation -- it is thought that it is generated when the solute or solvent in liquid is crowded minute amount picking in an oxide film. It is considered to raise insulation, withstand voltage, and hillock control nature that the carbon atom which constitutes especially a solute or a solvent is incorporated by the oxide film.

[0023] formation of this invention -- especially the conditions that anodize a metal using liquid are not restricted. the temperature at the time of anodic oxidation -- formation -- liquid is limited to the temperature requirement which exists in stability as a liquid, is within the limits of -20-150 degrees C at the time of general, and is within the limits of 10-100 degrees C preferably. The current at the time of anodic oxidation and especially the control approach of an electrical potential difference are not limited, but can combine suitably the conditions by which an oxide film is formed in a surface of metal. Usually, it degases by constant current to the formation voltage (Vf) defined beforehand, and after reaching formation voltage, on the electrical potential difference, fixed time amount maintenance is carried out and it anodizes. The current density in this case is 0.001 - 100 mA/cm2. It is made within the limits and is 0.01 - 10 mA/cm2 preferably. It is made within the limits. Moreover, Vf is usually set up within the limits of 2-200V, and is preferably carried out within the limits of 5-150V. In addition, instead of DC power supply, the alternating current with a fixed peak current value may be used, and the approach of changing to direct current voltage and carrying out fixed time amount maintenance in the place which reached formation voltage may be adopted until it results in formation voltage.

[0024] moreover, formation of this invention -- anodic oxidation using liquid may be performed by covering the whole metal, and may go only to the part. When forming a mill scale in metaled [some], the part which should be beforehand anodized by approaches, such as a photoresist, is chosen. formation of this invention -- the metal anodized using liquid may be heat-treated in order to raise the insulation of an oxide film further. For example, insulation can be raised by heating at about 200-500 degrees C.

[0025] Moreover, insulation may be further strengthened by forming insulator layers other than the oxide film formed by anodic oxidation. For example, it sets for a TFT component and is the SiN film and SiO2. The film can be formed. although these film is formed at an elevated temperature 200 degrees C or more -- the bottom of such an elevated temperature -- also setting -- formation of this invention -- generating of a hillock is controlled as long as the oxide film is formed with liquid.

[0026] formation of this invention -- if liquid is used, a metal can be anodized widely. Aluminum or an aluminium alloy can be mentioned as a target metal. In the case of an aluminium alloy, especially the class and number of metaled that are combined with aluminum are not restricted. therefore, the aluminum or the aluminium alloy which can

be used for wiring of a TFT component or an integrated circuit -- all -- formation of this invention -- it can anodize effectively with liquid.
[0027] Since a hillock tends [comparatively] to generate pure aluminum in high activity, the alloy which carries out minute amount content of the elements other than aluminum is preferably used as a wiring material. For example, the alloy (JP,8-250494,A) which mixed rare earth elements, such as Sc, Y, La, Pr, Nd, Gd, Dy, Ho, and Er, is used for aluminum. formation of this invention -- liquid can be suitably used to the aluminium alloy containing such rare earth elements, the aluminium alloy which contains Sc, Nd, or Gd preferably, and the aluminium alloy which contains Nd preferably especially.
[0028] For example, the aluminium alloy containing rare earth elements, such as a metal wiring thin film by which patterning was carried out, especially Sc, Nd, Gd, is preferably applicable to the wiring thin film obtained by carrying out sputtering on a substrate. Although especially the content of the rare earth elements in an aluminium alloy is not restricted, generally it is 0.01 - 10% of the weight of within the limits preferably 0.01 to 20% of the weight.
[0029] formation of this invention -- liquid can be used for the alloy (JP,8-286209,A) which mixed bulb metals which mixed Si, Cu, and Pd in addition to the above-mentioned alloy, such as an alloy, and Ti, Ta, Zr, Hf, Nd, W, Mo. If these elements are added to aluminum, generally electric resistance will increase remarkably. For this reason, as for the addition of these elements, it is common to about 0.01 - 3% to usually make a stop and electric resistance below into 5micro ohm-cm preferably below 10micro ohm-cm. moreover -- what was deposited as an intermetallic compound of an addition metal and aluminum by heating at about 300-450 degrees C after mixing an addition metal and aluminum -- formation of this invention -- liquid can be used.
[0030] formation of this invention -- the oxide film formation approach using liquid can be widely used in various technical fields. For example, it can use for structural materials, such as an aircraft, a vessel, a car, and a building, household articles, an optical instrument, etc. for the purpose of giving corrosion resistance and weatherability. Moreover, it can also use for an anodized aluminum wire, a print power distribution substrate, an electrolytic capacitor, a magnetic-recording disk, a switching element, a humidity sensor, etc. electric and for the purpose of giving an electronic and magnetic property. Moreover, it can also use for a solar heat-absorptive plate, a reflecting plate, multicolor alumite, photosensitive alumite, a light emitting device, a fluorescence component, IC heat sink, etc. for the purpose of giving light and a thermal property. Moreover, it can also use for lubrication alumite, hard anodic oxidation coatings, a loudspeaker diaphragm, etc. for the purpose of giving a specific mechanical property. Furthermore, it can also use for PS printing plate, a nameplate, an ornament panel, an imprint drum, etc. for the purpose of giving the description on printing, an ornament, and a design. In addition, it can also use for a catalyst, gas conditioning alumite, an adsorbent, ion permselective membrane, and a filtration membrane.
[0031] formation of this invention -- the oxide film formation approach using liquid is useful especially when high insulation is required of an oxide film like wiring of a TFT component or an integrated circuit. It is very effective if it uses for insulator layer formation of gate wiring of a TFT component used for a liquid crystal display component especially. There are two kinds of top gate molds indicated to be the bottom gate molds shown in drawing 1 to drawing 2 by the built-up sequence of gate wiring of TFT

components put in practical use now. Although this invention can be used for any TFT component of structure, in order to anodize, it is effectively applied with a bottom gate mold.

[0032] In order to manufacture the bottom gate mold TFT component shown in drawing 1 , patterning of the gate wiring (gate electrode) 2 is deposited and carried out by the sputtering method on the substrate 1 usually first made with alkali free glass. Gate wiring deposited at this time becomes the metal anodized at the following process. Therefore, in this invention, the aluminium alloy which usually carries out minute amount content of pure aluminum or the above-mentioned rare earth metal content metal, a bulb metal, Si, Cu, Pd, etc. is deposited as gate wiring. then, formation of this invention -- by anodizing using liquid, the oxide film 3 excellent in insulation is formed in the front face of the gate electrode 2, it heat-treats if needed, and the insulation of an oxide film is raised. Furthermore, when it is necessary to raise the insulation between a gate electrode and a semi-conductor layer, with a CVD method, the SiN film is deposited and gate dielectric film 4 is formed. the bottom of the elevated temperature according to heat treatment of an oxide film 3 or CVD this time -- gate wiring -- formation of this invention -- since liquid is used, generating and growth of a hillock are controlled. On gate dielectric film 4, the semi-conductor layer 5 is formed further. Although the amorphous substance conventionally heat-treated above 450 degrees C or the silicon film of polycrystal has been used for the semi-conductor layer, recently, the polycrystalline silicon film heat-treated at low temperature 350 degrees C or less is developed, and it is likely for heat treatment to fall in the future to about 300 degrees C. Finally, a TFT component can be manufactured by forming the source electrode 6 and the drain electrode 7 on the semi-conductor layer 5. moreover, formation of this invention -- an electrode can be prepared on the oxide film formed using liquid, and it can also consider as a one terminal pair network mold nonlinear device.

EXAMPLE

[Example] Although an example is given to below and this invention is explained to it still more concretely, the component shown in the following examples, a rate, operating procedure, etc. can be suitably changed, unless it deviates from the pneuma of this invention. Therefore, the range of this invention is not restricted to the example shown in the following examples.

[0034] (Example 1) The alloy thin film (90-% of the weight aluminum, 10 % of the weight Nd) with a thickness of about 400nm was deposited by the sputtering method on the glass substrate. this thin film is indicated in Table 1 -- each -- formation -- the inside of liquid -- current density 1 mA/cm2 The oxide film was formed by carrying out constant current formation and carrying out constant-voltage formation after that to 100V, for about 2 hours. Furthermore, under nitrogen-gas-atmosphere mind, it heat-treated at 300 degrees C, and the coat was stabilized. Then, about 400nm of aluminum was deposited by the sputtering method, the electrode thin film was formed, and the MIM mold component which has the pattern of 1mmphi was created.

[0035] The alloy thin film of this MIM mold component was made into the ground, the electrical potential difference was impressed by the 0V to 1V unit by having used aluminum thin film as the working electrode, and the leakage current was measured. The electrical potential difference on which the current 100mA or more flowed was recorded

as withstand voltage between two electrodes. A result is shown in Table 1. In addition, when microscope observation was performed, most hillocks were not accepted in each oxide film.

[0036]

[Table 1]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the sectional view of a bottom gate mold TFT component.

[Drawing 2] It is the sectional view of a top gate mold TFT component.

[Description of Notations]

1 Substrate
2 Gate Electrode
3 Oxide Film
4 Gate Dielectric Film
5 Semi-conductor Layer
6 Source Electrode
7 Drain Electrode

TECHNICAL FIELD

[Field of the Invention] this invention -- the object for metal oxide film formation -- formation -- it is related with the metal which comes to form an oxide film by the formation approach of liquid and the metal oxide film using it, and its approach. the specific formation for anodizing a metal especially aluminum, or an aluminium alloy, and forming an oxide film in detail, -- it is related with the metal which comes to form an oxide film by the formation approach of liquid and the metal oxide film using it, and its approach. This invention can be used especially effective in the chemical conversion of gate wiring of the thin film semiconductor (TFT) component of a liquid crystal display panel, or wiring of an integrated circuit.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] this invention -- the object for metal oxide film formation -- formation -- it is related with the metal which comes to form an oxide film by the formation approach of liquid and the metal oxide film using it, and its approach. the specific formation for anodizing a metal especially aluminum, or an aluminium alloy, and forming an oxide film in detail, -- it is related with the metal which comes to form an oxide film by the formation approach of liquid and the metal oxide film using it, and its approach. This invention can be used especially effective in the chemical conversion of gate wiring of the thin film semiconductor (TFT) component of a liquid crystal display panel, or wiring of an integrated circuit.
[0002]
[Description of the Prior Art] Various industrial use is presented with the metal and the alloy using the characteristic property. Since specific resistance is especially small, aluminum, an aluminium alloy, etc. are effectively used to wiring of a TFT component or an integrated circuit. In order to make it not short-circuit these wiring between other wiring or an electrode, to form an insulator layer in a front face is needed.
[0003] As an approach of forming an insulator layer in front faces, such as aluminum and an aluminium alloy, there is a chemical conversion method by anodic oxidation. this approach -- front faces, such as aluminum and an aluminium alloy, -- formation -- it is the approach of forming an oxide film in that front face by oxidizing electrochemically in liquid. Since this approach has the function which restores the defect resulting from the heterogeneity of a substrate, it is excellent in the point which can form a precise and smooth oxide film easily. For this reason, the oxide film forming method by chemical conversion is effectively used in the wiring production process of a TFT component or an integrated circuit.
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propylene glycol 1% in JP,61-133662,A 1:3 -- liquid is used. moreover, the formation which diluted the tartaric-acid water solution with ethylene glycol or propylene glycol 3%, and adjusted pH to about seven with aqueous ammonia in JP,2-85826,A -- liquid is used. the formation which mixed 1% ammonium tartrate water solution, 1% adipic-acid ammonium water solution, 1% ammonium oxalate water solution or 1% ammonium citrate water solution, and ethylene glycol by the volume ratio 3:7 in JP,6-216389,A -- liquid is used.

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[0006] moreover, in JP,11-229157,A the formation which dissolved the salt of an inorganic acid in the solvent which has an alcoholic hydroxyl group -- liquid by JP,11-246994,A the formation which dissolved the salt of aromatic carboxylic acid in the solvent which has an alcoholic hydroxyl group -- liquid in WO 99/No. 25906 official report the formation which dissolved the salt of the aliphatic series dicarboxylic acid of the carbon numbers 3-5 which do not have a hydroxyl group in the solvent which has an alcoholic hydroxyl group -- the formation which dissolved the solute chosen from the salt of liquid and inorganic oxo acid, and the salt of an organic carboxylic acid in the solvent which is mainly concerned with an aprotic organic solvent -- liquid is used.

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[Problem(s) to be Solved by the Invention] however, the above-mentioned formation -- about liquid, even if it anodizes a metal, especially aluminum and an aluminium alloy using this, the oxide film which has sufficient insulation cannot be formed. For this reason, in order to prevent dielectric breakdown, another insulator layer must be further formed on the formed oxide film. Especially on the occasion of manufacture of a TFT component, with the CVD method, the thick SiN film is formed on an oxide film, and insulation is compensated. Since a CVD method is performed at an elevated temperature, the needlelike minute projection called the hillock produced in the aluminum content surface of metal at this time grew, and it broke through gate dielectric film, and has also derived the problem of making a display panel producing a defect.

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[Embodiment of the Invention] Hereafter, this invention is explained to a detail.
(For metal oxide film formation formation liquid) formation of this invention -- it is characterized by liquid coming to contain the salt of amino acid as a solute. formation of this invention -- as long as it is the compound which has an amino group and a carboxyl group in a monad about the amino acid used for liquid, it may not be limited especially and a natural thing or a natural composite thing is [any of an L type, D mold, and DL mold are sufficient as the mold, and] sufficient as it.
[0012] As an example of amino acid, for example A glycine, an alanine, a valine, a leucine, Neutral amino acid, such as an isoleucine (monoamino monocarboxylic acid); An amino malonic acid, An aspartic acid, glutamic acid, alpha-aminoadipic acid, alpha-amino pimelic acid, Acidic amino acid of ** (monoamino dicarboxylic acid); Basic amino acid (diamino monocarboxylic acid); phenylalanines, such as a lysine and an arginine, Aromatic amino acid, such as a thyrosin; Sulfur-containing-amino-acid; serines, such as a cysteine, a cystine, and a methionine, Oxyamino acid, such as threonine; A histidine, a tryptophan, a proline, Amino acid which has heterocycles, such as a hydroxyproline; an asparagine, a glutamine, hydroxyproline, a glycylglycine, a glutathione, gamma-aminobutyric acid, aminocaproic acid, a diamino Valerin acid, a citrulline acid, etc. can be illustrated. These can also be used independently and can also be used combining plurality.
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[0014] These solutes may use a kind independently and may use it combining two or more sorts. Moreover, you may use it combining the above-mentioned solute and solutes other than the above. formation of this invention -- as for the solute concentration of liquid, it is common to set it as 0.001 - 30% of the weight of within the limits, and it is desirable to set it as 0.05 - 15% of the weight of within the limits. Even if forming [of a metal oxide film] becomes that solute concentration is less than 0.001 % of the weight inadequate since conductivity is insufficient, and solute concentration uses it exceeding 30 % of the weight, it is an opposite effect at the engine performance of about [not being economical] and a metal oxide film.
[0015] formation of this invention -- the main solvent used for liquid is a non-aqueous solvent. Here, the main solvent means that the rate in a solvent is 50 % of the weight or more. As a non-aqueous solvent, the solvent and aprotic organic solvent which have an

alcoholic hydroxyl group are desirable, and the solvent which has an alcoholic hydroxyl group is more desirable in these.
[0016] although not limited especially about the solvent which has an alcoholic hydroxyl group, fatty alcohol is desirable and can mention polyhydric alcohol, such as dihydric alcohol; glycerols, such as monohydric-alcohol; ethylene glycol, such as a methanol, ethanol, 1-propanol, 2-propanol, 1-butanol, a 2-ethyl-1-hexanol, and a cyclohexanol, propylene glycol, butane -1, 4-diol, and a diethylene glycol, and pentaerythritol, as the example, for example. Moreover, the solvent which has functional groups other than an alcoholic hydroxyl group in intramolecular can also be used unless the expected effectiveness of this invention is checked. For example, the solvent which has an alkoxy group can also be used like 2-methoxyethanol or diethylene glycol monoethyl ether.
[0017] About an aprotic organic solvent, any of a polar solvent or a nonpolar solvent may be used. as a polar solvent, gamma-butyrolactone, gamma-valerolactone, delta-valerolactone, etc. are annular -- carboxylate; methyl acetate -- Chain-like carboxylate, such as methyl propionate; Ethylene carbonate, Annular carbonates, such as propylene carbonate, butylene carbonate, and vinylene carbonate; Dimethyl carbonate, Chain-like carbonates;N-methyl formamides, such as ethyl methyl carbonate and diethyl carbonate, N-ethyl formamide, N.N-dimethylformamide, N, and N-diethyl formamide, Amides, such as N-methyl acetamide, N,N-dimethylacetamide, and N-methyl pyrrolidone; An acetonitrile, Nitril, such as guru taro nitril, an adiponitrile, a methoxy acetonitrile, and 3-methoxy propionitrile; phosphoric ester, such as trimethyl phosphate and triethyl phosphate, can be illustrated.
[0018] Moreover, a hexane, toluene, a silicone oil, etc. can be illustrated as a nonpolar solvent. These solvents may use a kind independently and may use it combining two or more sorts. formation of this invention -- especially a desirable solvent is independent or the mixed solvent of ethylene glycol and propylene glycol for liquid. Moreover, as a solvent, less than 30% of the weight of water can also be added and used preferably less than 50% of the weight. The content of water in case a solvent contains water is less than 0.1 - 20 % of the weight more preferably less than 0.1 to 25% of the weight.
[0019] (The formation approach of a metal oxide film) formation of this invention -- liquid can be used effective in metaled anodic oxidation. the formation currently used from the former -- although the oxide film which has a good property to a metal was not able to be formed with liquid -- formation of this invention -- the oxide film which was excellent when using liquid can be formed.
[0020] namely, formation of this invention -- if a metal is anodized using liquid -- the conventional formation -- compared with the case where it anodizes using liquid, insulation can form a high oxide film. moreover, formation of this invention -- if it anodizes using liquid -- the conventional water-solution system -- formation -- liquid -- comparing -- constant current -- since the time amount which formation takes is short and ends, it can manufacture by the high throughput.
[0021] furthermore, formation of this invention -- if the oxide film is formed using liquid, generating and growth of a hillock by high temperature processing in a subsequent process can also be controlled. therefore, formation of this invention -- if liquid is used, an oxide film with high withstand voltage can be formed efficiently. moreover, formation of this invention -- the oxide film formed using liquid may function also as the impurity cutoff sex skin film, the protective film of wiring or a substrate, a protective coating, a

coloring coat, and a hygroscopic coat.
[0022] an operation of the amino acid with which the effectiveness which was excellent in such this invention has an amino group and a carboxyl group in intramolecular although it does not adhere to any theory -- formation -- the time -- formation -- it is thought that it is generated when the solute or solvent in liquid is crowded minute amount picking in an oxide film. It is considered to raise insulation, withstand voltage, and hillock control nature that the carbon atom which constitutes especially a solute or a solvent is incorporated by the oxide film.
[0023] formation of this invention -- especially the conditions that anodize a metal using liquid are not restricted. the temperature at the time of anodic oxidation -- formation -- liquid is limited to the temperature requirement which exists in stability as a liquid, is within the limits of -20-150 degrees C at the time of general, and is within the limits of 10-100 degrees C preferably. The current at the time of anodic oxidation and especially the control approach of an electrical potential difference are not limited, but can combine suitably the conditions by which an oxide film is formed in a surface of metal. Usually, it degases by constant current to the formation voltage (Vf) defined beforehand, and after reaching formation voltage, on the electrical potential difference, fixed time amount maintenance is carried out and it anodizes. The current density in this case is 0.001 - 100 mA/cm2. It is made within the limits and is 0.01 - 10 mA/cm2 preferably. It is made within the limits. Moreover, Vf is usually set up within the limits of 2-200V, and is preferably carried out within the limits of 5-150V. In addition, instead of DC power supply, the alternating current with a fixed peak current value may be used, and the approach of changing to direct current voltage and carrying out fixed time amount maintenance in the place which reached formation voltage may be adopted until it results in formation voltage.
[0024] moreover, formation of this invention -- anodic oxidation using liquid may be performed by covering the whole metal, and may go only to the part. When forming a mill scale in metaled [some], the part which should be beforehand anodized by approaches, such as a photoresist, is chosen. formation of this invention -- the metal anodized using liquid may be heat-treated in order to raise the insulation of an oxide film further. For example, insulation can be raised by heating at about 200-500 degrees C.
[0025] Moreover, insulation may be further strengthened by forming insulator layers other than the oxide film formed by anodic oxidation. For example, it sets for a TFT component and is the SiN film and SiO2. The film can be formed. although these film is formed at an elevated temperature 200 degrees C or more -- the bottom of such an elevated temperature -- also setting -- formation of this invention -- generating of a hillock is controlled as long as the oxide film is formed with liquid.
[0026] formation of this invention -- if liquid is used, a metal can be anodized widely. Aluminum or an aluminium alloy can be mentioned as a target metal. In the case of an aluminium alloy, especially the class and number of metaled that are combined with aluminum are not restricted. therefore, the aluminum or the aluminium alloy which can be used for wiring of a TFT component or an integrated circuit -- all -- formation of this invention -- it can anodize effectively with liquid.
[0027] Since a hillock tends [comparatively] to generate pure aluminum in high activity, the alloy which carries out minute amount content of the elements other than aluminum is preferably used as a wiring material. For example, the alloy (JP,8-250494,A) which

mixed rare earth elements, such as Sc, Y, La, Pr, Nd, Gd, Dy, Ho, and Er, is used for aluminum. formation of this invention -- liquid can be suitably used to the aluminium alloy containing such rare earth elements, the aluminium alloy which contains Sc, Nd, or Gd preferably, and the aluminium alloy which contains Nd preferably especially.
[0028] For example, the aluminium alloy containing rare earth elements, such as a metal wiring thin film by which patterning was carried out, especially Sc, Nd, Gd, is preferably applicable to the wiring thin film obtained by carrying out sputtering on a substrate. Although especially the content of the rare earth elements in an aluminium alloy is not restricted, generally it is 0.01 - 10% of the weight of within the limits preferably 0.01 to 20% of the weight.
[0029] formation of this invention -- liquid can be used for the alloy (JP,8-286209,A) which mixed bulb metals which mixed Si, Cu, and Pd in addition to the above-mentioned alloy, such as an alloy, and Ti, Ta, Zr, Hf, Nd, W, Mo. If these elements are added to aluminum, generally electric resistance will increase remarkably. For this reason, as for the addition of these elements, it is common to about 0.01 - 3% to usually make a stop and electric resistance below into 5micro ohm-cm preferably below 10micro ohm-cm. moreover -- what was deposited as an intermetallic compound of an addition metal and aluminum by heating at about 300-450 degrees C after mixing an addition metal and aluminum -- formation of this invention -- liquid can be used.
[0030] formation of this invention -- the oxide film formation approach using liquid can be widely used in various technical fields. For example, it can use for structural materials, such as an aircraft, a vessel, a car, and a building, household articles, an optical instrument, etc. for the purpose of giving corrosion resistance and weatherability. Moreover, it can also use for an anodized aluminum wire, a print power distribution substrate, an electrolytic capacitor, a magnetic-recording disk, a switching element, a humidity sensor, etc. electric and for the purpose of giving an electronic and magnetic property. Moreover, it can also use for a solar heat-absorptive plate, a reflecting plate, multicolor alumite, photosensitive alumite, a light emitting device, a fluorescence component, IC heat sink, etc. for the purpose of giving light and a thermal property. Moreover, it can also use for lubrication alumite, hard anodic oxidation coatings, a loudspeaker diaphragm, etc. for the purpose of giving a specific mechanical property. Furthermore, it can also use for PS printing plate, a nameplate, an ornament panel, an imprint drum, etc. for the purpose of giving the description on printing, an ornament, and a design. In addition, it can also use for a catalyst, gas conditioning alumite, an adsorbent, ion permselective membrane, and a filtration membrane.
[0031] formation of this invention -- the oxide film formation approach using liquid is useful especially when high insulation is required of an oxide film like wiring of a TFT component or an integrated circuit. It is very effective if it uses for insulator layer formation of gate wiring of a TFT component used for a liquid crystal display component especially. There are two kinds of top gate molds indicated to be the bottom gate molds shown in drawing 1 to drawing 2 by the built-up sequence of gate wiring of TFT components put in practical use now. Although this invention can be used for any TFT component of structure, in order to anodize, it is effectively applied with a bottom gate mold.
[0032] In order to manufacture the bottom gate mold TFT component shown in drawing 1 , patterning of the gate wiring (gate electrode) 2 is deposited and carried out by the

sputtering method on the substrate 1 usually first made with alkali free glass. Gate wiring deposited at this time becomes the metal anodized at the following process. Therefore, in this invention, the aluminium alloy which usually carries out minute amount content of pure aluminum or the above-mentioned rare earth metal content metal, a bulb metal, Si, Cu, Pd, etc. is deposited as gate wiring. then, formation of this invention -- by anodizing using liquid, the oxide film 3 excellent in insulation is formed in the front face of the gate electrode 2, it heat-treats if needed, and the insulation of an oxide film is raised. Furthermore, when it is necessary to raise the insulation between a gate electrode and a semi-conductor layer, with a CVD method, the SiN film is deposited and gate dielectric film 4 is formed. the bottom of the elevated temperature according to heat treatment of an oxide film 3 or CVD this time -- gate wiring -- formation of this invention -- since liquid is used, generating and growth of a hillock are controlled. On gate dielectric film 4, the semi-conductor layer 5 is formed further. Although the amorphous substance conventionally heat-treated above 450 degrees C or the silicon film of polycrystal has been used for the semi-conductor layer, recently, the polycrystalline silicon film heat-treated at low temperature 350 degrees C or less is developed, and it is likely for heat treatment to fall in the future to about 300 degrees C. Finally, a TFT component can be manufactured by forming the source electrode 6 and the drain electrode 7 on the semi-conductor layer 5. moreover, formation of this invention -- an electrode can be prepared on the oxide film formed using liquid, and it can also consider as a one terminal pair network mold nonlinear device.

[0033]

[Example] Although an example is given to below and this invention is explained to it still more concretely, the component shown in the following examples, a rate, operating procedure, etc. can be suitably changed, unless it deviates from the pneuma of this invention. Therefore, the range of this invention is not restricted to the example shown in the following examples.

[0034] (Example 1) The alloy thin film (90-% of the weight aluminum, 10 % of the weight Nd) with a thickness of about 400nm was deposited by the sputtering method on the glass substrate. this thin film is indicated in Table 1 -- each -- formation -- the inside of liquid -- current density 1 mA/cm2 The oxide film was formed by carrying out constant current formation and carrying out constant-voltage formation after that to 100V, for about 2 hours. Furthermore, under nitrogen-gas-atmosphere mind, it heat-treated at 300 degrees C, and the coat was stabilized. Then, about 400nm of aluminum was deposited by the sputtering method, the electrode thin film was formed, and the MIM mold component which has the pattern of 1mmphi was created.

[0035] The alloy thin film of this MIM mold component was made into the ground, the electrical potential difference was impressed by the 0V to 1V unit by having used aluminum thin film as the working electrode, and the leakage current was measured. The electrical potential difference on which the current 100mA or more flowed was recorded as withstand voltage between two electrodes. A result is shown in Table 1. In addition, when microscope observation was performed, most hillocks were not accepted in each oxide film.

[0036]

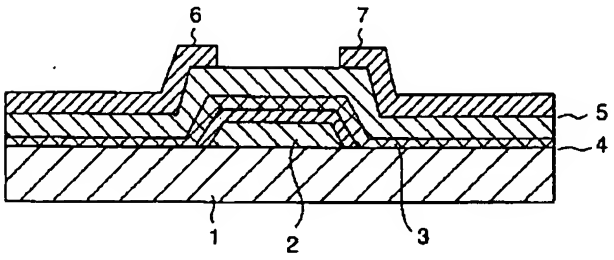
[Table 1]

[0037]
[Effect of the Invention] clear from Table 1 -- as -- formation of this invention -- the case where liquid is used -- the conventional formation,. compared with the case where liquid is used, the insulation of the anodic oxidation object coat formed is high. moreover, formation of this invention -- the oxide film formed using liquid can prevent growth of a hillock also in subsequent high temperature processing. namely, formation of this invention -- if liquid is used, the oxide film with which insulation is high with an oxide film and can control a hillock effectively can be manufactured. formation of this invention -- liquid can be widely used for the product and components for which anodic oxidation of a metal especially aluminum, or an aluminium alloy is needed If it uses for insulator layer formation of gate wiring of a TFT component especially, needlessness or when it can be made thin, the dependability of a component can also raise a SiN insulator layer. Moreover, also when it uses for wiring of an integrated circuit, since withstand voltage can be made high, dependability can be raised.

CLAIMS

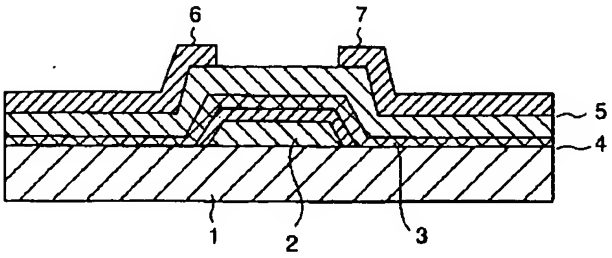
[Claim(s)]
[Claim 1] the object for metal oxide film formation which comes to contain the salt of amino acid as a solute -- formation -- liquid.
[Claim 2] the formation according to claim 1 whose amino acid is an aspartic acid or glutamic acid -- liquid.
[Claim 3] formation -- the formation according to claim 1 whose main solvent of liquid is a non-aqueous solvent -- liquid.
[Claim 4] the formation according to claim 3 whose non-aqueous solvent is a solvent which has an alcoholic hydroxyl group -- liquid.
[Claim 5] the formation according to claim 4 whose solvent which has an alcoholic hydroxyl group is ethylene glycol or propylene glycol -- liquid.
[Claim 6] formation according to claim 1 to 5 -- the formation approach of a metal oxide film including the process which anodizes a metal in liquid.
[Claim 7] The formation approach according to claim 6 which is the metal wiring thin film with which patterning of said metal was carried out on the substrate.
[Claim 8] The formation approach according to claim 7 from which said metal thin film wiring is obtained by sputtering of aluminum or an aluminium alloy.
[Claim 9] The formation approach according to claim 7 or 8 that the aluminium alloy with which said metal thin film wiring contains rare earth elements is wiring by which patterning was carried out on the substrate.
[Claim 10] The formation approach according to claim 9 that said rare earth elements are a kind of elements chosen from Sc, Nd, and Gd at least.
[Claim 11] The metal which comes to form an oxide film in a front face by the approach according to claim 6 to 10.
[Claim 12] The aluminium alloy which comes to form an oxide film in a front face by the approach according to claim 6 to 10.

Drawing selection drawing 1



[Translation done.]

Drawing selection drawing 2



[Translation done.]